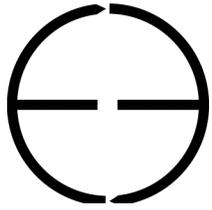


# California Council for Environmental & Economic Balance

## *Once Through Cooling Systems*

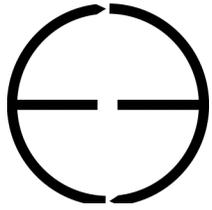
State Water Resources Control Board  
Phase II 316(b) Workshop – Oakland, CA  
December 7, 2005



## Once Through Cooling Systems (OTC)

### *Agenda*

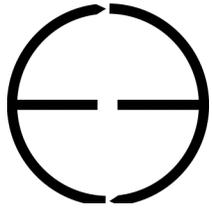
- ✓ *Impacts from Once Through Cooling – Are they Biologically Significant?*
- ✓ *Viability of Alternative Cooling Systems*
- ✓ *Recommendations for State Guidance*



## Once Through Cooling Systems (OTC)

### *What are the Environmental Impacts at OTCs?*

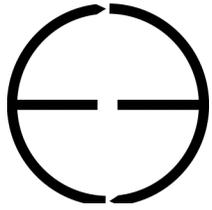
- ✓ *Sources of Impacts*
  - ❖ *Impingement (I) of adult fish and shellfish*
  - ❖ *Entrainment (E) of larval stages of fish and shellfish*
- ✓ *CA facilities with OTC systems use very large quantities of water for power plant cooling*
- ✓ *However, large numbers of entrained organisms at OTCs DOES NOT equal significant impacts to adult populations*
  - ❖ *There are enormous quantities of planktonic organisms in seawater*
  - ❖ *Natural spawning results in huge numbers of eggs & larvae*
    - *Example: A single female halibut produces as many as 50 million eggs/year for as long as 20 years, or 1 billion eggs over a lifetime*
  - ❖ *Natural mortality of larvae is greater than 99.9% in many fishes, and less than 0.1% survival to adulthood is needed to maintain the population*



## Once Through Cooling Systems (OTC)

### *OTC Impacts are Biologically Insignificant*

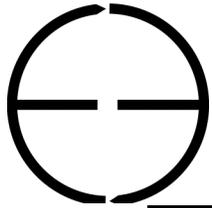
- ✓ *Around the late 1970's and early 1980's, all power plants using OTC systems were required to perform 316(b) impact assessments to determine if they were having significant ecological impacts*
- ✓ *These original studies evaluated the impacts to adult fish populations (Adult Equivalent Losses) around these facilities*
- ✓ *OTC studies have found Adult Equivalent Losses at OTC facilities to be generally less than 1-2% of adult fish stocks*
- ✓ *CDFG Nearshore Fisheries Management Plan*
  - ❖ *An over-fished stock = 30% of unfished biomass*
  - ❖ *Fishery controls are required at 60% of unfished biomass*
  - ❖ *These thresholds are exclusive to adult fish*



## Once Through Cooling Systems (OTC)

### *OTC Impacts are Biologically Insignificant*

- ✓ *More recent studies at many facilities have yielded similar information to the historical studies, but have included an additional modeling technique (Proportional Entrainment)*
- ✓ *OTC studies have found Proportional Entrainment Mortality to be generally low, averaging approximately 10 percent or less of the source water larval populations, varying by species*
- ✓ *Facts and Findings of these studies demonstrated the following:*
  - ❖ *OTCs are not damaging coastal fisheries*
  - ❖ *OTCs do not adversely affect CA's present or future populations of marine organisms being entrained*
  - ❖ *OTCs do not adversely affect the beneficial uses of CA's coastal waters*

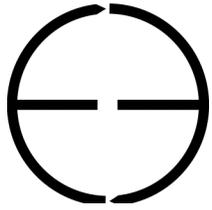


## Once Through Cooling Systems (OTC)

### *Summary Entrainment Impacts from OTC Studies*

Facility Intake	Adult Equivalent Losses as a percentage of adult source water populations	Average Proportional Entrainment Mortality as a percentage of source water larval populations	Study Year
El Segundo	0.10 – 0.76 %	NA	1980
Huntington Beach	NA	0.6 %	2004
Diablo Canyon	NA	8.6 %	1996-1999
SONGS	0.01 – 6.9 %	NA	1979-1986
Moss Landing	NA	13.1 %	1999
Morro Bay	NA	21.0 %	2000
Scattergood	0.001 – 0.2 %	NA	1981
Harbor	0.8 – 1.8%	NA	1981
Haynes	NA	NA	1981
South Bay	NA	13.4 %	2001

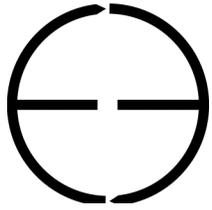
Note: the values represent only those fish species entrained in the highest numbers as well as recreational or commercial species.



## Once Through Cooling Systems (OTC)

### *OTC Impacts are Biologically Insignificant*

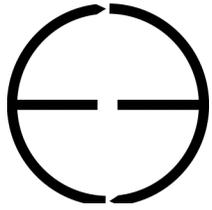
- ✓ *Small forage (non-fished) fishes, such as gobies, are usually the most abundant larvae entrained by OTCs*
- ✓ *Comparisons of original versus newer I&E studies have found goby entrainment rates to be very similar – indicating that adult populations have not declined since the original studies*
- ✓ *Goby densities at Agua Hedionda Lagoon (where cooling water is drawn for the Encina Power Station) are higher than the nearby Batiquitos Lagoon, which has no power plant*
- ✓ *20 years of studies at Diablo Canyon have shown no significant declines in nearshore fish populations*
- ✓ *Compensatory mechanisms enable species survival in spite of high natural mortality rates and impacts to adults and larvae caused by fishing and other factors*



## Once Through Cooling Systems (OTC)

### *Phase II 316(b) Will Significantly Reduce I&E*

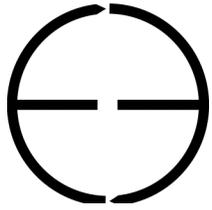
- ✓ *Historically, 316(b) was focused on “impacts” and whether or not those were biologically significant*
- ✓ *Phase II 316(b) does not require “impact” assessments*
  - ❖ *Instead EPA chose to use I&E reduction standards as a “relatively easy to measure and certain metric” (7/9/2004 FR, pg 41600) to accomplish reductions in impacts*
    - Impingement reduction standard = 80-95% reduction
    - Entrainment reduction standard = 60-90% reduction
  - ❖ *Finds that meeting the I&E standards will meet the Best Technology Available requirement of CWA 316(b) and will address I&E impacts*



## Once Through Cooling Systems (OTC)

### *EPA Does Not Require Retrofit to Wet or Dry Cooling*

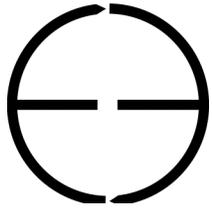
- ✓ *EPA concluded they would not mandate closed cycle cooling (wet cooling towers) for Phase II facilities (7/9/2004 FR, pg 41605):*
  - ❖ *High retrofit and operating costs are not economically practicable*
  - ❖ *Other technologies available that meet performance standards*
  - ❖ *Very high energy efficiency impacts*
- ✓ *EPA concluded that they would not mandate dry cooling at Phase II facilities (7/9/2004 FR, pg 41608):*
  - ❖ *Not an economically practicable option*
  - ❖ *Not an “available” technology for many facilities*
  - ❖ *Would likely cause significant closures of generating stations*
  - ❖ *Extremely high energy efficiency impacts*



## Once Through Cooling Systems (OTC)

### *Issues with Wet/Dry Cooling Tower Systems*

- ✓ *Very High Retrofit Costs and Increased Operating & Maintenance Costs*
  - ❖ *LADWP/SONGS Retrofit Cost Estimates:*
    - Dry Cooling = \$465 - \$500 million
    - Wet Cooling = \$205 – \$400 million
  - ❖ *EPA Cost Estimates (high flow plants):*
    - Wet Tower Retrofit Costs = \$130 – 200 million
    - Wet Tower O&M Costs = \$4 – 20 million
  - ❖ *EPRI Cost Estimates*
    - Wet Tower Easy Retrofit = \$100K/megawatt
    - Wet Tower Difficult Retrofit = \$250K/megawatt
- ✓ *Inadequate real estate at many generating stations*
  - ❖ *Located on tight coastal properties*
  - ❖ *Limited access to real estate expansion opportunities*



## Once Through Cooling Systems (OTC)

### *Issues with Wet/Dry Cooling Tower Systems (continued)*

#### ✓ *Increased Environmental Impacts*

##### ❖ *Increased emissions of air contaminants*

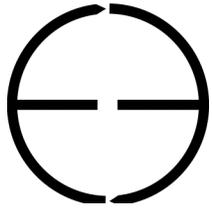
- Due to increased firing of fossil fuels to compensate for lost efficiency
- Particulate Matter directly emitted from wet cooling towers

##### ❖ *Increased community noise impacts*

##### ❖ *Visual resources – wet plumes and large equipment footprints & height*

##### ❖ *Heavy use of potable and/or reclaimed water supplies*

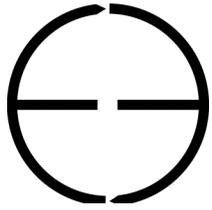
- Restricts use of these water supplies for other uses (SWB Resolution 75-58)
- Storage, pumping, and transport of water supplies have their own environmental and social impacts



## Once Through Cooling Systems (OTC)

### *Issues with Wet/Dry Cooling Tower Systems (continued)*

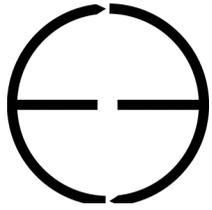
- ✓ *Energy Efficiency/Energy Penalty Impacts*
  - ❖ *Wet Tower efficiency losses range from 2.4 % to 5.3 % (7/9/2004 FR, pg 41605)*
  - ❖ *Dry Tower efficiency losses range from 8.6 % to 10 % (EPA 316(b) Technical Development Document)*
- ✓ *Assuming wet/dry cooling retrofits were required at all 21 CA facilities using OTC (approximately 24,000 MWs), how would it affect CA power generation supply and cost?*
  - ❖ *Wet Towers = 924 MWs of lost capacity (equivalent to two large scale combined cycle plants)*
  - ❖ *Dry Towers = 2232 MWs of lost capacity (equivalent to one of CA's nuclear power plants or 4-5 large combined cycle plants)*
  - ❖ *Total Capital Costs to retrofit to wet or dry cooling would range from \$1.1 to \$4.2 Billion*



## Once Through Cooling Systems (OTC)

### *316(b) Implementation Guidance is Needed*

- ✓ *State role should be to ensure that the federal rule is consistently applied at the Regional Water Boards*
- ✓ *Need guidance around areas where the federal rule is vague and/or unclear*
- ✓ *A new and different formal policy not needed*
  - ❖ *EPA closely evaluated all available options and concluded Phase II 316(b) is the best rule - Don't reinvent the wheel*
  - ❖ *Insufficient time to complete policy development*
  - ❖ *Federal rule requires action now*
  - ❖ *Federal rule will significantly reduce I&E at OTCs regardless of the low level of ecological impacts*



## Once Through Cooling Systems (OTC)

### *316(b) Implementation Guidance is Needed*

- ✓ *Potential Topics for State Guidance:*
  - ❖ *Calculation Baseline – including alternatives for establishing appropriate credit for existing I&E controls*
  - ❖ *Compliance Implementation Challenges – construction permitting and CEQA*
  - ❖ *Benefits Valuation – alternatives for cost/benefit analysis*
  - ❖ *Restoration Measures – alternatives for developing projects*
  - ❖ *Definition of “not significantly greater than” for purposes of establishing compliance cost caps for facilities under the site specific determination option*